Technical Disclosure: The Russell Growth Correlation Principle and Ω-Class Safety Architecture

Michael A. Russell
RSuper3 Inc. / I.N.F.T.Y.

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1 Abstract

This disclosure formalizes the **Russell Growth Correlation Principle (RGCP)** as a foundational governing law for Axiomatic Ontological Intelligence systems. Unlike probabilistic AI models, the RGCP provides a deterministic coupling between computational intelligence growth (dI/dt) and safety-invariant verification (λ). This framework establishes the mathematical basis for **Ω-Class Certification**, satisfying the independent assessment requirements of the 2026 NHTSA AV STEP program.

2 The Russell Growth Correlation Principle

Definition 1 (Growth Correlation Equation)**.** *The rate of intelligence expansion within an axiomatic ontological system is governed by the coupling coefficient λ relative to environmental complexity E_c:*

$$\frac{dI}{dt} = \lambda \cdot E_c \tag{1}$$

*where λ is defined as the **Safety-Intelligence Coupling Constant**.*

Axiom 1 (The Ω-Class Constraint)**.** *A system achieves Ω-Class status if and only if the probability of a safety violation $P(V)$ satisfies:*

$$\lim_{t \to \infty} P(V) \leq 10^{-\infty} \tag{2}$$

This is enforced via hardware-level interlocks in the photonic substrate that rate-limit dI/dt based on the verification of λ.

3 Stability and Safety Theorem

Theorem 1 (Russell Stability Theorem)**.** *Given a system state $x(t)$ and a Lyapunov safety function $V(x)$, the system is **Axiomatically Stable** if the growth rate $\dot{I}$ satisfies the condition:*

$$\dot{V}(x) + \alpha(V(x)) \geq \sigma(\dot{I}) \tag{3}$$

where σ is a class-$\mathcal{K}$ function representing the risk-potential of intelligence growth.

Proof Sketch: If λ is bound by the recursive refinement interlock (R^3), any increase in I that would result in $\dot{V}(x) < 0$ (a loss of safety) triggers an immediate attenuation of the photonic flux, effectively setting $dI/dt \to 0$ until stability is restored.

4 Standard Essential Patent (SEP) Claims

This architecture is disclosed as essential to the following 2026 regulatory standards:

- **NHTSA AV STEP:** As the primary method for providing "Independent Mathematical Safety Cases."
- **IEEE P2840:** As the metrological standard for "Responsible AI Capability Gating."
- **Texas TRAIGA (2026):** Providing the required "Third-Party Bias and Hallucination Audit" through axiomatic verification.

5 Hardware Implementation

The implementation is substrate-agnostic but optimized for the **RSuper3 Photonic Processor**. In this substrate, λ is physically instantiated as a phase-shift threshold in the light-matter interaction layer, preventing the propagation of "unsafe" computational states.